IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
IN RE THE APPLICATION OF:

Yoshino et al.	Grp. Art. Unit: 3745
Application No: 10/714,171	Examiner: Lopez, Frank
Filing Date: November 14, 2003	Date: December 19, 2005
POWER SYSTEM AND WORK MACHINE USING SAME	Atty. Dkt. No: 03-227

APPELLANT'S APPEAL BRIEF

I Real Party In Interest

Caterpillar Inc. of Peoria, Illinois and Shin Caterpillar Mitsubishi LTD of Japan, as the assignees, are the real parties in interest.

II Related Appeals And Interferences

There are no related appeals or interferences.

III Status of Claims

Claims 1-17 stand finally rejected.

IV Status Of Amendments

No amendments to the claims have been filed subsequent to final rejection.

V Summary Of Invention

In one aspect, a power system (14, pg. 5, ln. 7) includes an electric motor (21, pg. 5, ln. 8) that is operable to power a hydraulic pump (22, pg. 5, ln. 8) that is fluidly connected to at least one hydraulic cylinder (15, pg. 5, ln. 10). The hydraulic cylinder (15, pg. 5, ln. 10) defines a first fluid volume (23, pg. 5, ln. 11) and a second fluid volume (24, pg. 5, ln. 12) that are separated by a movable plunger (19, pg. 5, ln. 18). A variable displacement hydraulic motor (35, pg. 7, ln. 10), which is operable to power a generator (37, pg. 7, ln. 29), is fluidly connected to the first fluid volume (23, pg. 7, ln. 18) and the second fluid volume (24, pg. 7, ln. 18). The generator (37, pg. 8, ln. 7) is operably coupled to the electric motor (21, pg. 8, ln. 21) via a power storage

system (38, pg. 8, ln. 4).

In another aspect, there is a method of operating an electrical power system (14, pg. 9, ln. 26). A variable displacement hydraulic motor (35, pg. 10, ln. 20) converts hydraulic power created within a hydraulic cylinder (15, pg. 7, ln. 16) to mechanical power in order to power a generator (37, pg. 7, ln. 29). The power generated by the generator (37, pg. 8, ln. 2) is stored in a power storage system (38, pg. 8, ln. 4). In order to power a hydraulic pump (22, pg. 9, ln. 12), the electrical power is supplied from the power storage system (38, pg. 9, ln. 4) to an electric motor (21, pg. 9, ln. 13) that is coupled to the hydraulic pump (22, pg. 9, ln. 12). The hydraulic pump (22, pg. 10, ln. 11) supplies hydraulic fluid to the hydraulic cylinder (15, pg. 7, ln. 16).

VI Issues For Appeal

Whether claims 1-17 are unpatentable under 35 USC. §103 over Japan reference 2002-195218 in view of Maruta et al.(US Patent No. 6, 460,332).

VII Grouping Of Claims

Claims 1-17 stand or fall together.

VIII Argument

Applicant concedes that the claimed invention is not pioneering, but it does represent a nonobvious patentable improvement over the inventor's own work illustrated in the cited Japanese reference 2002-195218. Applicant improved upon his previous work by substituting a variable displacement hydraulic motor in place of a combination throttle inlet valve and fixed displacement hydraulic motor in a regenerative power system. The final office action urges that one with ordinary skill in the art would have found a combination throttle valve with a fixed displacement hydraulic motor and a variable hydraulic motor to be obvious substitutional equivalents in the context of the claimed invention. Thus, the final rejections can only be fairly interpreted as suggesting that the Applicant, who has been recognized by the Patent and Trademark Office on at least one other occasion as having more than ordinary skill in the art, should have found it obvious to generate a supposedly equivalent apparatus by substituting a superior variable displacement motor in place of an inferior combination of a throttle valve and fixed displacement hydraulic motor.

While MPEP §2144.06 recognizes that equivalent substitutions that are recognized in the prior art are prima facie obvious under §103, this MPEP section has been misapplied in the present case for several reasons. First, a variable displacement motor is superior, which is the antithesis of equivalency, to a combination throttle valve and fixed displacement hydraulic motor. Second, there is no recognition in the prior art as to any supposed equivalency. And third, the Maruta et al. reference teaches variable displacement pump operation, but does not show or suggest or motivate one with ordinary skill in the art to operate its hydraulic pump/motor in any manner other than as a fixed displacement motor.

At the threshold is the question of whether a variable displacement motor is the equivalent of a fixed displacement motor coupled with a throttle valve; they are not. A variable displacement motor has capabilities impossible to achieve with a fixed displacement motor coupled with a throttle valve. For instance, in the presence of a given pressure differential across a variable displacement motor, its displacement can be adjusted to vary flow rate, speed and torque from the motor. By setting a low displacement, the motor can have a low torque, high speed and low flow rate through the motor. On the other hand, at a large displacement for the same pressure differential, the motor can produce higher torques, lower speeds and higher flow rates through the motor. If the same pressure differential is applied across a fixed displacement motor, it will respond with whatever torque, speed and flow rate that the pressure differential corresponds to. The addition of a throttle valve merely allows the pressure differential across the fixed displacement motor to be artificially reduced, which results in a lower torque, lower speed and lower flow rate than when the throttle valve is wide open.

At a given pressure differential, a variable displacement motor has the ability to raise or lower both torque and speed as well as flow rate through the motor, whereas the fixed displacement motor coupled with a throttle valve only has the ability to decrease torque, speed and flow rate from some maximum corresponding to when the throttle valve is wide open. When pressure across the motor is varying, such as due to the weight load carried by the hydraulic cylinder (changing with each different load), the capability differences become even more profound. These differences may be best revealed when a load is low and the pressure differential across the motor is also relatively low. When this occurs, the variable displacement motor can be adjusted to a higher displacement in order to achieve a speed and flow rate output that may not even be possible with the counterpart throttle valve and fixed displacement motor.

In other words, when the pressure differential is low, the combination throttle valve and fixed displacement motor can only respond by opening the throttle valve wide open and accepting whatever flow rate, speed and torque is available at the lower pressure differential. These differing capabilities have profound consequences in the context of Applicant's claimed invention. The variable displacement motor provides substantially more control over the torque, speed and flow rate than that possible with the counterpart throttle valve and fixed displacement motor. This can be important when one is trying to utilize a variable displacement motor verses fixed displacement motor and valve combination, to control a movement rate of a hydraulic cylinder to control a rate that a load is moved under the force of gravity. There should also be no dispute that an electric generator coupled to the hydraulic motor is preferably driven in a certain range of speeds in order to achieve optimal efficiency. The variable displacement motor is going to inherently have more capabilities in finding an acceptable mixture of flow rate, motor speed(generator speed) and torque than that possible with a throttle valve and fixed displacement motor. Thus, substitution of the variable displacement motor in place of a fixed displacement motor coupled with a throttle valve can only fairly be characterized as an improvement. In other words, if the two things can only fairly be described as unequal to one another, they inherently cannot be characterized as equivalents. Applicant's claimed improvement should be recognized in a manner similar to the literally hundreds of thousands of other incremental improvements made by inventors to other devices. Applicant respectfully requests that the outstanding rejections be overturned on the ground that an improving substitution is inherently incapable of being characterized as an obvious equivalent substitution under MPEP §2144.06.

Even if a variable displacement motor could be fairly characterized as the equivalent of a combination throttle valve and fixed displacement motor in the context of Applicant's claimed invention, MPEP §2144.06 requires that the prior art recognize the equivalency of the two things being substituted. There is no dispute that the supposed equivalency is neither explicitly recognized, nor pictorially recognized. In this case, the office action asserts that the supposed equivalency is apparent based upon faulty reasoning that the substituted devices function the same, when they really do not. The office action urges that the supposed equivalency is recognized in the art based upon an assertion that the Japanese reference teaches the use of the combination throttle valve with the fixed displacement motor as a means of varying flow rate through the motor, and urges that Maruta et al. teaches the same thing with regard to its variable

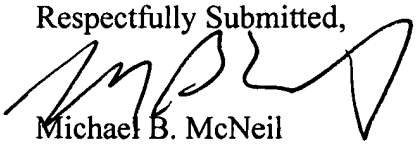
displacement pump/motor. Applicant respectfully disagrees since Maruta et al. contains absolutely no teaching regarding any variation in the displacement through their device when it is functioning as a motor. Instead, Maruta et al. only teaches the use of its variable displacement function when their device is being operated as a pump. When one reads the Maruta et al. reference thoroughly, it becomes clear that the variable displacement feature is only utilized when their device is operating as a pump, but no utterance is made regarding controlling the variable displacement when the device is operated as a motor to recover hydraulic energy as in Applicant's claimed invention. Therefore, the supposed equivalency recognition rests upon what the Maruta et al. device could do, even though Maruta et al. never taught a variable motor function. The cited reference fails to teach operating its motor to vary flow rate or anything else, and certainly makes no mention whatsoever regarding what a throttle valve and fixed displacement motor can or cannot do. Since there is no explicit, pictorial, inherent or implicit recognition of equivalency to support the substitution, the rejections do not satisfy the requirement of MPEP §2144.06, and should be reversed.

There should be no dispute that if equivalency under MPEP §2144.06 is to have any meaning at all, the supposedly equivalent substitution in the claimed invention ought to also be an equivalent substitution in the cited reference. In this case, Applicant has already demonstrated that the substitution of a variable displacement motor in place of the fixed displacement motor and throttle valve of the Applicant's own work will produce a superior system with capabilities not possible before the substitution. Applicant further contends that the lack of equivalency for the identified substitution can further be demonstrated by imagining the substitution of the supposedly equivalent throttle valve and fixed displacement motor into Maruta et al. Recalling that Maruta et al. teaches their device as being operable as both a pump and a motor at different times, in contrast Applicant's claim is only to a motor. Maruta et al. teaches its pump as being driven by an electric motor coupled to a battery. No electrical control other than a switch is shown or suggested. Thus, the battery can be assumed to have a fixed voltage, which produces a fixed torque from the electric motor, which in turn applies a fixed torque to the pump 18 of Maruta et al. There should be no dispute that when the Maruta et al. device is functioning as a pump, it is pressure output from the pump that will determine whether a hydraulic cylinder can be moved to lift a load against the force of gravity. With a fixed torque from a fixed displacement pump substituted into Maruta et al., even with an unthrottled valve, it

may not be producing sufficient pressure to even allow the pump to rotate, and the throttle valve can do nothing to increase a pressure differential across the device when it is operating as a pump. Thus, the asserted substitution in reverse into the Maruta et al. system would surely fail to function. Thus, the substitution identified in the office action is neither equivalent, nor recognized as equivalent in the context of either Applicant's claimed invention or the cited art. Therefore, Applicant again respectfully requests that the outstanding rejections be reversed.

There should be no dispute that Applicant has claimed an improvement over his own previous work, not something that could be characterized as an equivalent substitution that would be in the realm of routine skill in the art. Since the Examiner has relied upon MPEP §2144.06 and the relevant case law to support the rejections, and because Applicant has shown that the claimed substitution cannot satisfy the requirements under MPEP §2144.06, the rejections must be reversed. Therefore, Applicant respectfully requests that the outstanding §103 rejections be overruled as contrary to the mandates of the MPEP and relevant case law, and that this application proceed to allowance as a patentable improvement over the Applicant's own previous work.

Respectfully Submitted,



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IX Appendix

List of Claims

1. (previously presented) A power system comprising:

an electric motor being operable to power a hydraulic pump;

at least one hydraulic cylinder being fluidly connected to the hydraulic pump and defining a first fluid volume and a second fluid volume separated from one another via a moveable plunger;

a variable displacement hydraulic motor being fluidly connected between the first fluid volume and the second fluid volume defined by the hydraulic cylinder and being operable to power a generator; and

a power storage system operably coupling the generator to the electric motor.

2. (original) The power system of claim 1 wherein the power storage system includes a fuel cell, an electrolysis device and a hydrogen storage device.

3. (original) A work machine comprising a work machine body; and the power system of claim 1 being attached to the work machine body.

4. (original) The work machine of claim 3 including an implement attached to the work machine body; and

the at least one hydraulic cylinder being operably coupled to move the implement.

5. (previously presented) A power system comprising:

means for converting hydraulic power produced within at least one hydraulic cylinder to mechanical power via a variable displacement hydraulic motor fluidly connected between a first fluid volume and a second fluid volume of the hydraulic cylinder;

means for converting the mechanical power to electrical power;

means for storing the electrical power;

means for supplying an electric motor coupled to a hydraulic pump with the stored electrical power; and

means for supplying hydraulic fluid, via the hydraulic pump, to the at least one hydraulic cylinder.

6. (original) The power system of claim 5 wherein the means for storing electrical power includes a fuel cell, an electrolysis device and a hydrogen storage device.

7. (original) The power system of claim 5 wherein the at least one hydraulic cylinder being operably coupled to move a work machine implement.

8. (previously presented) A method of operating an electrical power system, comprising the steps of:

powering a generator, at least in part, by converting hydraulic power produced within a hydraulic cylinder to mechanical power via a variable displacement hydraulic motor fluidly connected between a first fluid volume and a second fluid volume of the hydraulic cylinder;

storing electrical power created by the generator within a power storage system;

powering a hydraulic pump, at least in part, by supplying electrical power from the power storage system to an electric motor coupled to the hydraulic pump; and

supplying hydraulic fluid to the hydraulic cylinder, at least in part, by operating the hydraulic pump.

9. (previously presented) The method of claim 8 wherein the step of powering the generator includes a step of producing hydraulic power by retracting a plunger, which separates the first fluid volume from the second fluid volume, within the hydraulic cylinder.

10. (original) The method of claim 9 wherein the step of producing hydraulic power includes a step of controlling a speed of the retracting plunger, at least in part, by varying the displacement of the motor.

11. (original) The method of claim 8 wherein the step of storing includes a step of producing hydrogen within a reformer.

12. (original) The method of claim 8 wherein the step of storing includes a step of creating hydrogen and oxygen within an electrolysis device from electrical power generated by the generator.

13. (original) The method of claim 12 wherein the step of storing includes a step of absorbing the hydrogen in a hydrogen storage device.

14. (original) The method of claim 13 includes a step of powering a hydraulic pump includes a step of re-producing electrical power, at least in part, by combining the hydrogen with oxygen in a fuel cell.

15. (previously presented) A power system comprising:

a variable displacement hydraulic motor being configured to power a generator;

a power storage system being configured to store electrical power produced by the generator;

an electric motor being configured to power a hydraulic pump with the electrical power from the power storage system; and

a hydraulic cylinder being configured to receive hydraulic fluid from the hydraulic pump and to produce hydraulic power that drives the variable displacement hydraulic motor, which is fluidly connected between a first fluid volume and a second fluid volume of the hydraulic cylinder.

16. (original) The power system of claim 15 wherein the power system includes a fuel cell, an electrolysis device and a hydrogen storage device.

17. (original) The power system of claim 15 wherein the at least one hydraulic cylinder being operably coupled to move a work machine implement.